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THE ASTONISHING CONFLICT OF TIME DILATION WITHIN RELATIVITY

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Abstract

We show that if we assume the existence of a frame in vacuum where the one-way speed of light is c (c is the measured value of the two-way speed of light in vacuum) than for another frame moving with velocity v_1 in relation to that frame we can have time dilation, time contraction or no difference of proper times change at all. Therefore, the standard formulation is a result of a misinterpretation of the mathematical expression between the relation of the proper time of the moving frame in relation to the difference of times of Lorentzian clocks, the so-called time dilation. This is an astonishing conflict that standard formulation cannot solve. This result is easily obtained if we assume time dilation in relation to Einstein Frame (EF) the frame where the speed of light is isotropic.

Keywords: simultaneity, synchronization, Einstein frame, intrinsic desynchronization, Lorentz transformation, IST transformation, time dilation and contraction, Lorentz-FitzGerald contraction and dilation, resolution twin paradox

1. Introduction

Recently one more interesting article questioned the accuracy of the postulate of the constancy of the speed of light and the meaning of time dilation has been published [1]. In a first work [2] we address the failure of standard formulation in relation to the existence of Einstein Frame (EF) the unique frame where the one-way speed of light is isotropic [1, 2]. Now with the same token we address time dilation. This is a problem of semiotic where the problem of symbols and meaning is crucial as we formulate with the intrinsic desynchronization that necessitate the new symbol t_L' for the Lorentzian time (https://en.wikipedia.org/wiki/Semiotics).

2. Time dilation and Lorentz Transformation

In a previous article "Special Relativity as a Simple Geometry Problem" [3] we obtain geometrically time dilation in relation to a frame where the speed of light is isotropic independently of the movement of the source. Therefore, we obtain the IST Transformation connected to Time Dilation and Lorentz-FitzGerald contraction [1-3]

$$x' = \frac{x - v_1 t}{\sqrt{\left(1 - \frac{v_1^2}{c^2}\right)}} \qquad (1)$$

$$t' = t\sqrt{\left(1 - \frac{v_1^2}{c^2}\right)} \qquad (2)$$

Indeed, consider frames S and S'. S is the EF and S' is a frame moving in a standard configuration in relation to S with velocity v_1. This standard configuration is S' moving through x of S. O′ the origin of S' coincide with O the origin of S and O′ moves through the x axis of S with v_1. When O′ coincide with O the origin O′′ of another frame S'' coincide also with O′ and is moving from O′ through $x'=l_1$ with velocity v_2 in relation to EF. Therefore, we have time dilation with v_2

$$t'' = t\sqrt{\left(1 - \frac{v_2{}^2}{c^2}\right)} \qquad (3)$$

and Lorentz-FitzGerald contraction

$$x'' = \frac{x - v_2 t}{\sqrt{\left(1 - \frac{v_2{}^2}{c^2}\right)}} \qquad (4)$$

This is enough to obtain Lorentz Transformation through a change of coordinates based on the expression of intrinsic desynchronization introduced by us [4-9],

$$t_L^{'} = t' - \frac{v_1}{c^2}x' \qquad (5)$$

Introducing (5) in (1) and (2) (and the similar procedure for (3) and (4)) we obtain [2, 3-116]

$$x'' = \frac{x' - v_E^{'} t_L^{'}}{\sqrt{\left(1 - \frac{v'_E{}^2}{c^2}\right)}} \qquad (6)$$

$$t_L^{''} = \frac{t_L^{'} - \frac{v_E^{'}}{c^2}x'}{\sqrt{\left(1 - \frac{v'_E{}^2}{c^2}\right)}} \qquad (7)$$

with

$$v_E^{'} = \frac{dx'}{dt_L^{'}} = \frac{v_2 - v_1}{1 - \frac{v_1 v_2}{c^2}} \qquad (8)$$

Therefore, if we consider the clock O'' moving with Einstein speed $v_E^{'}$ through x' we obtain

$$x' = l_1 = v_E^{'}\, t_L^{'} \qquad (9)$$

Therefore, substituting (9) in (7)

$$t_L'' = \frac{t_L'(1 - \frac{v_E'^2}{c^2})}{\sqrt{\left(1 - \frac{v'_E{}^2}{c^2}\right)}} = t_L' \sqrt{\left(1 - \frac{v'_E{}^2}{c^2}\right)} \quad (10)$$

From (5) and (9)

$$t_L' = t' - \frac{v_1}{c^2} v_E' \, t_L' \quad (11)$$

From (11)

$$t' = t_L' \left(1 + \frac{v_1}{c^2} v_E'\right) \quad (12)$$

Introducing (12) in (10) with $t' = \tau'$, and with $t_L'' = \tau''$ we obtain

$$\tau'' = \frac{\tau'}{\left(1 + \frac{v_1}{c^2} v_E'\right)} \sqrt{\left(1 - \frac{v'_E{}^2}{c^2}\right)} \quad (13)$$

Therefore, the relation of τ'' and τ' is not the relation that standard formulation confound as time dilation (relation (10)) since consider "Einstein synchronization" a synchronization [4-11].

Therefore, we can reapproach the twin paradox [23-25, 106-118]. Consider standard configuration previously referred:

Consider frames S and S'. S is the EF and S' is a frame moving in a standard configuration in relation to S with velocity v_1. This standard configuration is S' moving through x of S. O′ the origin of S' coincide with O the origin of S and O′ moves through the x axis of S with v_1. When O′ coincide with O the origin O′′ of another frame S'' coincide also with O′ and is moving from O′ through $x'=l_1$ with velocity v_2 in relation to EF.

From (10) with $t_L'' = \tau_+''$ and $t_L' = \frac{l_1}{|v'_{E+}|}$ we obtain for the trip +

$$\tau''_{+} = \frac{l_1}{|v'_{E+}|}\sqrt{\left(1 - \frac{v'^{2}_{E+}}{c^2}\right)} \qquad (14)$$

with $v'_{E+} = \frac{v_2 - v_1}{1 - v_1 v_2}$ when $v_2 > v_1$.

Similarly, for the returning trip $-$,

$$\tau''_{-} = \frac{l_1}{|v'_{E-}|}\sqrt{\left(1 - \frac{v'^{2}_{E-}}{c^2}\right)} \qquad (15)$$

with $v'_{E-} = \frac{v_2 - v_1}{1 - v_1 v_2}$ when $v_2 < v_1$.

We have also that the proper time of S' associated to trip + between the origin and $x'=l_1$ is (the proper time of any synchronized clock located in S′)

$$\tau'_{+} = \frac{l_1}{|v'_{+}|} \qquad (16)$$

with

$$v' = \frac{dx'}{dt'} = \frac{dx'}{dt'_L}\frac{dt'_L}{dt'} = v'_E \frac{dt'_L}{dt'} \qquad (17)$$

Since

$$t'_L = t' - \frac{v_1}{c^2}x' \qquad (18)$$

we obtain

$$\frac{dt'_L}{dt'} = 1 - \frac{v_1}{c^2}\frac{dx'}{dt'} = 1 - \frac{v_1}{c^2}v' \qquad (19)$$

Therefore, we obtain from (17) and (19)

$$v' = \frac{v'_E}{1 + \frac{v_1 v'_E}{c^2}} \qquad (20)$$

Therefore

$$\tau'_+ = \frac{l_1}{|v'_+|} = \frac{l_1}{|v'_{E+}|}\left(1 + \frac{v_1\, v'_{E+}}{c^2}\right) \quad (21)$$

$$\tau'_+ = \frac{l_1}{|v'_+|} = \frac{l_1}{|v'_{E+}|} + \frac{l_1 v_1}{c^2} \quad (22)$$

Similarly

$$\tau'_- = \frac{l_1}{|v'_-|} = \frac{l_1}{|v'_{E-}|}\left(1 - \frac{v_1\, |v'_{E-}|}{c^2}\right) \quad (23)$$

$$\tau'_- = \frac{l_1}{|v'_-|} = \frac{l_1}{|v'_{E-}|} - \frac{l_1 v_1}{c^2} \quad (24)$$

Finaly, we obtain the ageing of the "Earth twin" during the total trip,

$$\tau' = \tau'_+ + \tau'_- = \frac{l_1}{|v'_{E+}|} + \frac{l_1}{|v'_{E-}|} \quad (25)$$

From (14) and (15) and (25) we conclude that the twin that return is the younger but without affirming the symmetry of the ageing that standard approach enunciate

$$\tau'' = \tau''_+ + \tau''_- = \frac{l_1}{|v'_{E+}|}\sqrt{\left(1 - \frac{{v'_{E+}}^2}{c^2}\right)}$$

$$+ \frac{l_1}{|v'_{E-}|}\sqrt{\left(1 - \frac{{v'_{E-}}^2}{c^2}\right)} \quad (26)$$

From (25) and (26) we conclude that

$$\tau'' < \tau' \quad (27)$$

An astonishing conflict within relativity since Relativity affirm the equivalence of the frames and what we have is the preferred frame, *EF*. Therefore, we can understand the consistency of the asymmetry of (27) through (14) and (21)

$$\tau''_{+} = \frac{l_1}{|v'_{E+}|}\sqrt{\left(1-\frac{{v'_{E+}}^2}{c^2}\right)} < \tau'_{+} \quad (28)$$

since, (22) is

$$\tau'_{+} = \frac{l_1}{|v'_{+}|} = \frac{l_1}{|v'_{E+}|} + \frac{l_1 v_1}{c^2} \qquad (29)$$

Therefore

$$\tau''_{-} = \frac{l_1}{|v'_{E-}|}\sqrt{\left(1-\frac{{v'_{E-}}^2}{c^2}\right)} < \tau'_{-} \quad (30)$$

since from (24)

$$\tau'_{-} = \frac{l_1}{|v'_{-}|} = \frac{l_1}{|v'_{E-}|} - \frac{l_1 v_1}{c^2} \qquad (31)$$

Indeed when $v_2 < v_1, \tau'' < \tau'$ from (2) and (3).

Indeed from (2) and (3)

$$t'' = t'\frac{\sqrt{\left(1-\frac{{v_1}^2}{c^2}\right)}}{\sqrt{\left(1-\frac{{v_2}^2}{c^2}\right)}} \quad (34)$$

or

$$\tau'' = \tau' \frac{\sqrt{\left(1 - \frac{v_1{}^2}{c^2}\right)}}{\sqrt{\left(1 - \frac{v_2{}^2}{c^2}\right)}} \quad (35)$$

and therefore $\tau'' < \tau'$.

"De Abreu proposed to abandon the Relativity Principle in favor of 'restricted Relativity Principle' that allows the absolute space with a preferred reference system, referred to as 'the Einstein's lost frame'. This idea was future developed in [De Abreu 2002, 2004; De Abreu & Guerra 2005; Guerra & de Abreu 2006]. The velocity relative to the preferred reference system is said to be the absolute velocity, and a velocity relative to non-preferred system is said to be the Einstein velocity [De Abreu 2004]. The starting point of De Abreu (and jointly with Guerra) is the observation that the Einstein synchronization of clocks can be made in one and only one reference system. Analysis of the clock synchronization (related to one-way versus two-ways light velocity) leads Authors to consider the abandoning of the Relativity Principle (that all reference systems are equivalent)." [10, 11]

Conclusion

We consider a clock moving in relation to a preferred frame, EF. This clock has time dilated in relation to the clocks of EF. Therefore, this clock can have time contracted in relation to other clock moving with other speed in relation to EF. And the rhythms are the same if the speed is the same. This resolves the time dilation conundrum and the Twin Paradox. This is an astonishingly conflict of Relativity that has been solved in the context of Relativity.

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